

Objection under 35 U.S.C. 103(a) as being unpatentable over Miyasato et al. (U.S. Patent No. 5,865,911) in view of 2002 Bushmaster arms catalog

The Applicants respectfully request reconsideration and withdrawal of this objection for the following reasons:

Miyasato et al. clearly teaches a process for producing aluminum alloy structural members for aircraft and teaches many processing steps that are similar to that of the present invention. He also states a specific yield strength value of at least 62 ksi in the specification and selected claims.

Bushmasters Firearms catalog 2002 teaches the use of aircraft quality 7075 in a T6 temper for its gun receivers. Bushmaster also teaches that the gun receivers may be forged. The T6 temper inherently includes the steps of solution heat treatment, quenching and artificial aging.

The Patent Examiner states that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the aluminum alloy of Miyasato et al. to manufacture firearms parts as taught by Bushmaster.

The combination of the Miyasato et al. teaching to manufacture firearms parts as taught by Bushmaster would be an inoperable combination. The Miyasato alloy, as used by Bushmaster would not achieve the strength required to produce the current invention.

The Applicants respectfully submit that alloy formulations with a yield strength value of at least 62 ksi have been prominently used as gun frames and gun components for many years. Alloy 7075, utilized by Bushmaster Firearms, is also widely used by other gun manufacturers. Significantly, alloy 7075 does have a yield strength value of at least 62 ksi, for example, the Aluminum Handbook states a yield strength value of 73 ksi for alloy 7075. The Applicants discuss alloy 7075 in some detail in the specification of the patent and its prominent use in pistol frames and low caliber revolvers.

In the case of heavy caliber handguns, the Applicants stated the following in the specification:

"Often, the 7075 frames break after just a few test firings, thereby excluding this material as a candidate for heavy caliber revolvers. In contrast, the gun frame comprised of the lightweight alloy stock of this invention withstood extensive test firings. Specifically, a .357 Magnum was mounted in a gun vise and subjected to 3000 rounds using an ultra-high caliber 158-grain .357 load. Even though this test is the equivalent of 9000 hand-fired rounds, the gun held up to this extensive number of firing cycles. Previously, only steel and titanium alloys have withstood such rigorous testing. It is significant that the starting stock of this invention can withstand the repeated firing loads since the gun

frame is just one-third the weight of steel handgun frames and 70% lighter than titanium alloy frames."

Lack of Implementation of Prior Art, Current Invention Teaches a Solution of a Long-Felt and Unsolved Need.

Miyasato et al., as stated by the Patent Examiner, did not anticipate that their invention for aircrafts structural members would be applicable to a gun frame or gun component. The patent assignee of the Miyasato et al. patent, the Aluminum Company of America, has sold aluminum alloys to gun manufactures for nearly 50 years. Alloy 7075 is the leading alloy that is now provided into this industry. If one skilled in the art were to take the alloy of the Miyasato et al., and attain a yield strength of at 62 ksi, the use of this material in a heavy caliber handgun frame would result in failure after just a few rounds of firing. Widely used alloy 7075, which has a higher yield strength value (73 ksi) than that proposed by Miyasato, has historically failed in firing trials within a few rounds. In contrast, the current invention provides a material that can last for >9000 hand fired rounds. With regard to the relatively smaller caliber handguns, the present invention allows for downsizing to smaller dimensions that cannot be achieved with alloy 7075.

Multiplicity of Steps

The Applicants also submit that the multiplicity of steps required in the present invention have not been previously stated in the prior art. Miyasato et al. state similar processing steps in their specification. Nevertheless, we do not recognize an instance whereby the sequence proposed in the present invention is specifically stated by the teaching of Miyasato et al. This is particularly evident in the fact that the Applicants proposed claims are relevant only to gun frames and gun components and only at yield strength values greater than 80 ksi.

Commercial Success and Professional Recognition of Present Invention.

The Applicants invention is now commercially used by Smith & Wesson as the frame material in several revolver models. A feature article states the following:

"Of course the aluminum frame/titanium cylinder design of the S&W Air-Lite Ti or the Taurus MultiAlloy offerings do have limitations – most obviously, no magnum chamberings. Titanium cylinders can be made more than strong enough to hand loads up to and including .357 Magnum, .41 Magnum and .44 Magnum, but typical firearms-grade aluminum alloy frames absolutely cannot – which is why there have never been any Airweight type aluminum frame/steel cylinder magnum revolvers in the first place." (*Shooting Times*, October 2000, pp 42-45).

Smith & Wesson is clearly one of the premier gun manufacturers in the world and was the pioneer in handgun development starting in 1852. Smith & Wesson also employed

aluminum alloys in handguns as early as 1952. Since that time, however, alloy 7075 has been the state-of-the-art in handguns frames. Nevertheless, the fact that alloy 7075 handgun frames will fracture when heavy caliber rounds are utilized has eliminated the consideration of this alloy for the heavy caliber handguns. Accordingly, gun designers at Smith & Wesson have never been able to lightweight their heavy caliber handguns.

Unexpected Results for the Present Invention

The Applicants have provided the current invention to Smith & Wesson, and the invention has lead to performance levels that were previously unattainable in their product engineering history. Smith & Wesson currently markets this innovation as their "AirLite Sc" models, and the product has attained commercial success. As stated in the current invention, *a lightweight alloy is now being used for the first time in heavy caliber handguns*. The method to produce lightweight gun frames and gun components is also employed to produce handgun cylinders, an unprecedented use of a lightweight alloy. Smith & Wesson also used the principles of this invention to redesign the gun frames of the smaller caliber handguns that were previously comprised of 7075. In this instance, the gun frames are smaller, thereby taking advantage of the higher strength afforded by this invention.

The Applicants submit that two significant results in the current patent application are unexpected results. First, while the increased strength was remarkable, the method to produce the starting stock for the gun frame would not previously be expected to withstand the repeated firing loads, an accomplishment that has heretofore been achieved only through the use of steel or titanium alloys. The fact that the current invention was utilized in a heavy caliber handgun that survived 9000 rounds of firing was a surprising result to the engineering staff at Smith & Wesson. Second, the fact that higher strength was attained would not guarantee the effectiveness of this invention to be utilized as the material of construction for the gun cylinder. In this environment, the high temperature and high velocity of the bullet discharge gases cause erosion of the interior of the cylinder when aluminum alloys are employed. Again, this application was previously the domain of steel and titanium alloys. By contrast, the current invention is already successfully employed as a gun cylinder in many Smith & Wesson models.

To underscore the importance of the different uses of the present invention, the Applicants submit that commercialization of this invention is in the early stages whereby designers are now recognizing the previously unappreciated advantage of employing this process in the production of many different gun frames and gun components. For example, the Bushmaster example stated by the Patent Examiner currently utilizes alloy 7075. If Bushmaster seeks to reduce the size of this component, they will reach a point where the 7075 cannot withstand the forces that are applied during operation. At that point, the present invention can be utilized, thereby enabling Bushmaster to achieve new performance levels.

Note: We have enclosed supporting material to the Patent Examiner that demonstrates the commercial success of this invention.

9. The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The Applicants agree that Shahani et al. (U.S. Patent No. 6,027,582 and Hunt, Jr. et al. (U.S. Patent No. 5,221,377) is pertinent to the Applicants disclosure.

Conclusion

For the above reasons, the applicant submits that the claims are now in proper form, and that the claims all define patentability over the prior art. Therefore, the applicant submits that this application is now in condition for allowance, which action they respectfully solicit.

Conditional Request for Constructive Assistance

The applicant has amended the claims of this application so that they are proper and define a novel invention that is also non-obvious. If, for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Very respectfully,



Wm. Troy Tack



Lawrence S. Kramer

----- Applicants -----

5401 Twin Knolls Rd., Ste. 11
Columbia, MD 21036
Tel) 410 884-8590
Fax) 410 884-8592

new phone # 410 - 489 - 0900

Certificate of Mailing: I certify that on the date below this document and referenced attachments will be deposited with the US Postal Service as first class mail in an envelope addressed to "Assistant Commissioner for Patents - Washington, DC 20231"

22 May 2002



Wm. Troy Tack, Applicant

7075 Strength Reference

#4

ASM Specialty Handbook[®]

Aluminum and Aluminum Alloys

Edited by
J.R. Davis
Davis & Associates

Prepared under the direction of the
ASM International Handbook Committee

Scott D. Henry, Manager of Handbook Development
Suzanne E. Frueh, Production Manager
Randall Boring, Production Coordinator
Dawn Levicki, Production Coordinator
Laurie Harrison, Editorial Assistant

William W. Scott, Jr., Director of Technical Publications



The Materials
Information Society

Table 108 Tensile properties of alloy 7075

Temper	Tensile strength		Yield strength		Elongation(a), %
	MPa	ksi	MPa	ksi	
Typical properties					
O	228	33	103	15	17
T6, T651	572	83	503	73 ← highest reported	11
T73	503	73	434	63	17
Alclad O	221	32	97	14	17
T6, T651	524	76	462	67	11
Property Limits					
	Minimum		Minimum		Minimum
Sheet and plate					
O	276 (max)	40 (max)	145 (max)	21 (max)	10
Sheet					
T6, T62					
0.008–0.011 in. thick	510	74	434	63	5
0.012–0.039 in. thick	524	76	462	67	7
0.040–0.125 in. thick	538	78	469	68	8
0.126–0.249 in. thick	538	78	476	69	8
T73	462	67	386	56	8
T76	503	73	427	62	8
Plate					
T62, T651					
0.250–0.499 in. thick	538	78	462	67	9
0.500–1.000 in. thick	538	78	469	68	7
1.001–2.000 in. thick	531	77	462	67	6
2.001–2.500 in. thick	524	76	441	64	5
2.501–3.000 in. thick	496	72	421	61	5
3.001–3.500 in. thick	490	71	400	58	5
3.501–4.000 in. thick	462	67	372	54	3
T7351					
0.250–2.000 in. thick	476	69	393	57	6–7
2.001–2.500 in. thick	455	66	359	52	6
2.501–3.000 in. thick	441	64	338	49	6
T7651					
0.250–0.499 in. thick	496	72	421	61	8
0.500–1.000 in. thick	490	71	414	60	6
Alclad sheet and plate					
O					
0.008–0.062 in. thick	248 (max)	36 (max)	138 (max)	20 (max)	9–10
0.063–0.187 in. thick	262 (max)	38 (max)	138 (max)	20 (max)	10
0.188–0.499 in. thick	269 (max)	39 (max)	145 (max)	21 (max)	10
0.500–1.000 in. thick	276 (max)	40 (max)	145 (max)	21 (max)	10
Alclad sheet					
T6, T62					
0.008–0.011 in. thick	469	68	400	58	5
0.012–0.039 in. thick	483	70	414	60	7
0.040–0.062 in. thick	496	72	427	62	8
0.063–0.187 in. thick	503	73	434	63	8
0.188–0.249 in. thick	517	75	441	64	8
T73					
0.040–0.062 in. thick	434	63	352	51	8
0.063–0.187 in. thick	441	64	359	52	8
0.188–0.249 in. thick	455	66	372	54	8
T76					
0.125–0.187 in. thick	469	68	393	57	8
0.188–0.249 in. thick	483	70	407	59	8
Alclad plate					
T62, T651					
0.250–0.499 in. thick	517	75	448	65	9
0.500–1.000 in. thick	538(b)	78(b)	469(b)	68(b)	7
1.001–2.000 in. thick	531(b)	77(b)	462(b)	67(b)	6
2.001–2.500 in. thick	524(b)	76(b)	441(b)	64(b)	5
2.501–3.000 in. thick	496(b)	72(b)	421(b)	61(b)	5
3.001–3.500 in. thick	490(b)	71(b)	400(b)	58(b)	5
3.501–4.000 in. thick	462(b)	67(b)	372(b)	54(b)	3
T7351					
0.250–0.499 in. thick	455	66	372	54	8
0.500–1.000 in. thick	476	69	393	57	7
T7651					
0.250–0.499 in. thick	476	69	400	58	8
0.500–1.000 in. thick	490(b)	71(b)	414(b)	60(b)	6

(a) In 50 mm (2 in.) or 4d, where d is diameter of reduced section of tensile test specimen. Where a range appears in this column, the specified minimum elongation varies with thickness of the mill product. (b) For plate 13 mm (0.500 in.) or over in thickness, listed properties apply to core material only. Tensile and yield strengths of composite plate are slightly lower than listed value, depending on thickness of cladding.

(a) In 50 mm (2 in.) or 4d, where d is diameter of reduced section of tensile test specimen. Where a range appears in this column, the specified minimum elongation varies with thickness of the mill product. (b) For plate 13 mm (0.500 in.) or over in thickness, listed properties apply to core material only. Tensile and yield strengths of composite plate are slightly lower than listed value, depending on thickness of cladding.

Thermal Properties

Liquidus temperature. 657 °C (1215 °F)

Solidus temperature. 641 °C (1185 °F)

Coefficient of thermal expansion. Linear:

Temperature range		Average coefficient	
°C	°F	μm/m · K	μin./in. · °F
–50 to 20	–58 to 68	21.8	12.1
20 to 100	68 to 212	23.6	13.1
20 to 200	68 to 392	24.5	13.6
20 to 300	68 to 572	25.5	14.2

Volumetric: $68 \times 10^{-3} \text{ m}^3/\text{m}^3 \cdot \text{K}$ ($3.78 \times 10^{-5} \text{ in.}^3/\text{in.}^3 \cdot ^\circ\text{F}$) at 20 °C (68 °F)

Specific heat. 893 J/kg · K (0.213 Btu/lb · °F) at 20 °C (68 °F)

Thermal conductivity. O temper: 227 W/m · K (131 Btu/ft · h · °F) at 20 °C (68 °F)

Electrical Properties

Electrical conductivity. Volumetric, O temper: 60% IACS at 20 °C (68 °F)

Electrical resistivity. 28.7 nΩ · m at 20 °C (68 °F); temperature coefficient, 0.1 nΩ · m per K at 20 °C (68 °F)

Electrolytic solution potential. –0.96 V versus 0.1 N calomel electrode in an aqueous solution containing 53 g NaCl plus 3 g H₂O₂ per liter at 25 °C (77 °F)

Chemical Properties

General corrosion behavior. High resistance to general corrosion. Provides galvanic protection when used as cladding on several different alloys

Fabrication Characteristics

Annealing temperature. 345 °C (650 °F)

7075, Alclad 7075**5.6Zn-2.5Mg-1.6Cu-0.23Cr****Specifications**

AMS. See Table 106.

ASTM. See Table 106.

SAE. J454

UNS number. A97075

Government. See Table 106.

Foreign. Austria: Önorm AlZnMg-Cu1.5. Canada: CSA ZG62, ZG62Alclad. France: NF A-75GU. Spain: UNE L-371. Switzerland: VSM Al-Zn-Mg-Cu; Alclad, Al-Zn-Mg-Cu-pl. United Kingdom: BS L.95, L.96. Germany: DIN AlZnMgCu1.5; Werkstoff-Nr. 3.4365. ISO: AlZn6MgCu

Chemical Composition

Composition limits of 7075. 1.20 to 2.0 Cu, 2.1 to 2.9 Mg, 0.30 Mn max, 0.40 Si max, 0.50 Fe max, 0.18 to 0.28 Cr, 5.1 to 6.1 Zn, 0.20 Ti max, 0.05 max other (each), 0.15 max others (total), bal Al

Composition limits of Alclad 7075. 7072 cladding—0.10 Cu max, 0.10 Mg max, 0.10 Mn max, 0.7 Si max + Fe, 0.8 to 1.3 Zn, 0.05 max other (each), 0.15 max others (total), bal Al